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EXAMINER

MARKHAM, WESLEY D

ART UNIT PAPER NUMBER

1762

DATE MAILED: 09/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/524,227

Applicant(s)

SPITSBERG, IRENE T.

Examiner

Wesley D Markham

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 21-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 March 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1 – 20, drawn to a method of improving the thermal fatigue life of a thermal barrier coating (TBC), classified in class 427, subclass 250.
- II. Claims 21 – 39, drawn to an aluminide bond coat, classified in class 428, subclass 615.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made, respectively.

The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product as claimed can be made by another and materially different process, such as (1) a process in which the bond coat recrystallization occurs during the deposition of the bond coat, not after it is deposited (as required by the process of Claims 1 – 10), (2) a process in which the aluminide bond coat is deposited by a process other than vapor phase aluminizing (VPA) or chemical vapor deposition (CVD), such as a “pack-process”; a process in which peening is carried out at an intensity slightly less than 6A; or a process in which the heat treatment is performed while peening or depositing the bond coat, not after (as required by Claims 11 – 19), and (3) a process in which the aluminide bond coat is deposited by a process other than vapor phase aluminizing (VPA) or

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chemical vapor deposition (CVD), such as a "pack-process"; a process in which peening is carried out at an intensity slightly less than 6A or slightly greater than 12A; or a process in which the heat treatment is performed while depositing the TBC on the bond coat, not before (as required by Claim 20).

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification and recognized divergent subject matter, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Mr. David Narciso on 8/26/2003, a provisional election was made with traverse to prosecute the invention of Group I, Claims 1 – 20. Affirmation of this election must be made by the applicant in replying to this Office Action. Claims 21 – 39 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

#### ***Information Disclosure Statement***

5. Acknowledgement is made of the IDS submitted by the applicant as paper #2 on 3/13/2000. The reference listed thereon has been considered by the examiner as indicated on the attached copy of the PTO-1449 form.

#### ***Drawings***

6. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: "4" in

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Figure 3. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office Action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### ***Specification***

7. The disclosure is objected to because of the following informalities:

- Page 5, line 14: The word “coat” appears to be misspelled “cot”.
- Page 7, line 23: The word “of” appears to be misspelled “f”.
- Page 10, lines 28 and 30: The use of the trademarks RENE’ N5 and RENE’ R142 has been noted in this application. They should be capitalized wherever they appear and be accompanied by the generic terminology. Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner that might adversely affect their validity as trademarks.

Appropriate correction is required.

### ***Claim Objections***

8. Claim 20 is objected to because of the following informalities: The phrase, “peening the diffusion aluminide coat bond coat...” on line 16 of Claim 20 appears to contain a typographical error. It appears as though the phrase should read, “peening the diffusion aluminide bond coat...” Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

11. Claim 20 recites the limitation "the new grains" in line 25 of the claim. There is insufficient antecedent basis for this limitation in the claim, thereby rendering the claim vague and indefinite under 35 U.S.C. 112, second paragraph. Specifically, it is unclear whether the "new grains" recited in Claim 20 refer to the grains formed (1) after peening the diffusion aluminide bond coat but before heat treating, (2) after heat treating the bond coat but before depositing the TBC, or (3) after depositing the TBC. Therefore, the scope of Claim 20 is unclear, and the claim is indefinite under 35 U.S.C. 112, second paragraph.

***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 1 and 4 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) in view of Nakamura et al. (JP 01-180959 A).

14. Regarding independent Claim 1, the AAPA teaches a method of making a thermal barrier coating (TBC) system by depositing an aluminide bond coat that adheres the thermal barrier coating to a surface of a superalloy component, the method comprising the step of depositing the aluminide bond coat on the component so as to be characterized by substantially columnar grains that extend substantially through the portion of the bond coat overlying the surface of the component, the grains having grain boundaries exposed at the surface of the aluminide bond coat (See "PRIOR ART" Figures 2 – 5, page 8, lines 8 – 34, page 9, lines 1 – 35, and page 10, lines 1 – 24, of the applicant's specification, which depict and describe a TBC system of a type known in the art). The AAPA does not explicitly teach improving the thermal fatigue life of the TBC by modifying the grain structure of the aluminide bond coat by recrystallizing at least a surface region of the aluminide bond coat during or prior to depositing the TBC on the surface of the bond coat, wherein new grains form at the surface of the bond coat. Nakamura et al. teaches that, after depositing a diffusion coating layer of Al (i.e., an aluminide bond coat) on the surface of a gas turbine component such as a blade (i.e., a process analogous to that taught by the AAPA), the diffusion coating layer is shot-peened and then heated to a temperature at or above the recrystallization temperature of the coating layer,

thereby causing recrystallized grains (i.e., "new grains") to form on the surface of the diffusion coating layer (Abstract). This recrystallization process advantageously allows the component / coating (1) to have an improved thermal fatigue resistance without deteriorating the corrosion resistance, (2) to have a low crack propagation speed due to the small grain size of the recrystallized grains, and (3) to have an increased resistance to the coating layer peeling-off (Abstract). Therefore, it would have been obvious to one of ordinary skill in the art to improve the thermal fatigue life of the TBC system of the AAPA by modifying the grain structure of the aluminide bond coat by recrystallizing at least a surface region of the aluminide bond coat during or prior to depositing the TBC on the surface of the bond coat, wherein new grains form at the surface of the bond coat, as taught by Nakamura et al., with the reasonable expectation of successfully and advantageously providing the coated superalloy component / blade of the AAPA with the following benefits: (1) an improved thermal fatigue resistance, (2) a lower crack propagation speed, and (3) an increased resistance to the peeling-off of the coating layer (i.e., the TBC system).

15. The combination of the AAPA and Nakamura et al. also teaches all the limitations of Claims 4 – 10 as set forth above in paragraph 14 and below, including a method wherein / further comprising:

- Claim 4: The new grains have a grain size of not smaller than 5 micrometers after recrystallization. Specifically, although Nakamura et al. teaches that the new grains are "small" and "fine" (Abstract), Nakamura et al. is silent as to the specific size of the recrystallized grains. However, the combination of the



AAPA and Nakamura et al. teaches each and every process step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the grain size obtained by the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process utilized by the applicant, and the combination of the AAPA and Nakamura et al. teaches the claimed recrystallization (i.e., peening / heating) process, the process of the combination of the AAPA and Nakamura et al. would have inherently produced new grains having a grain size of not smaller than 5 micrometers unless essential process steps and/or limitations are missing from the applicant's claims.

- Claim 5: The new grains are substantially equiaxed. Specifically, Nakamura et al. is silent regarding the orientation of the recrystallized grains. However, the combination of the AAPA and Nakamura et al. teaches each and every process step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the grain orientation obtained by the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process

utilized by the applicant, and the combination of the AAPA and Nakamura et al. teaches the claimed recrystallization (i.e., peening / heating) process, the process of the combination of the AAPA and Nakamura et al. would have inherently produced substantially equiaxed grains unless essential process steps and/or limitations are missing from the applicant's claims.

- Claim 6: The aluminide bond coat is a single-phase or two-phase aluminide (page 9, lines 17 – 19, of the applicant's specification).
- Claim 7: Precipitates are substantially absent from the grain boundaries. Specifically, the combination of the AAPA and Nakamura et al. is silent regarding precipitates at the grain boundaries. However, the combination of the AAPA and Nakamura et al. teaches each and every process step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the lack of grain boundary precipitates obtained in the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process utilized by the applicant, and the combination of the AAPA and Nakamura et al. teaches the claimed recrystallization (i.e., peening / heating) process, the process of the combination of the AAPA and Nakamura et al. would have inherently produced a bond coat having substantially no precipitates at the

grain boundaries unless essential process steps and/or limitations are missing from the applicant's claims.

- Claim 8: The aluminide bond coat is single-phase aluminide (page 9, lines 17 – 19, of the applicant's specification).
- Claim 9: The aluminide bond coat is a diffusion aluminide bond coat (page 8, lines 32 – 33, and page 9, lines 17 – 19, of the applicant's specification).
- Claim 10: The aluminide bond coat is an "overlay" aluminide bond coat. Specifically, since at least a portion of the aluminide bond coat (i.e., the additive layer "28") overlies the substrate (Figure 2, reference number "28", page 8, lines 9 – 11 and 34, and page 9, line 1, of the applicant's specification), the aluminide bond coat of the AAPA has been reasonably interpreted to be an "overlay aluminide bond coat", as required by Claim 10.

16. Claims 2, 11, and 13 – 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) in view of Nakamura et al. (JP 01-180959 A), and in further view of Loersch et al. (USPN 4,514,469).

17. The combination of the AAPA and Nakamura et al. teaches all the limitations of Claim 2 as set forth above in paragraph 14, except for a method wherein the recrystallization is induced by peening the bond coat at an intensity of at least 6A prior to heating the bond coat. Specifically, Nakamura et al. teaches inducing the recrystallization by peening the bond coat prior to heating the bond coat (Abstract) but does not explicitly teach the claimed peening intensity. As verified by an oral

translation from a USPTO translator, Nakamura et al. is silent regarding the specific peening intensity. However, it is clear that the peening intensity of Nakamura et al. must be high enough to induce plastic deformation to the diffusion coating layer (Abstract). Loersch et al. teaches that, in the art of peening bond coatings on metal workpieces such as turbine airfoils, the peening intensity must be high enough to achieve a good surface finish (e.g., closure of surface defects) in an economical period of time, but not so high as to chip or physically degrade the coating (Col.6, lines 54 – 68, and Col.7, lines 1 – 21). In other words, Loersch et al. teaches that the peening intensity is a result / effective variable that must be chosen / optimized to be high (i.e., to achieve a good surface finish in a short amount of time) but not too high (i.e., so that the coating or workpiece is not damaged). Therefore, it would have been obvious to one of ordinary skill in the art to optimize the peening intensity of the process of the combination of the AAPA and Nakamura et al. as a result / effective variable through routine experimentation in order to obtain a peening intensity that is high enough to achieve a good surface finish (i.e., high enough to provide the plastic deformation desired by Nakamura et al.) but not so high as to damage the aluminide bond coating or the workpiece itself.

18. Regarding independent Claims 11 and 20, the AAPA teaches a method of making a thermal barrier coating (TBC) system by depositing an aluminide bond coat, specifically a diffusion aluminide bond coat, that adheres the thermal barrier coating to a surface of a superalloy component, the method comprising the steps of depositing the (diffusion) aluminide bond coat on the component by VPA or CVD,

the bond coat comprising an additive layer on the surface of the component and a diffusion zone in a surface region of the component, the additive layer being characterized by substantially columnar grains that extend from the diffusion zone to the surface of the bond coat, the grains having grain boundaries exposed at the surface of the aluminide bond coat, and then depositing the TBC on the bond coat (See "PRIOR ART" Figures 2 – 5, page 8, lines 8 – 34, page 9, lines 1 – 35, and page 10, lines 1 – 24, of the applicant's specification, which depict and describe a TBC system of a type known in the art). The AAPA does not explicitly teach improving the thermal fatigue life of the TBC by modifying the grain structure of the (diffusion) aluminide bond coat by (1) peening the bond coat at an intensity of at least 6A (Claim 11), specifically at an intensity of 6A to 12A (Claim 20), (2) heat treating the bond coat before depositing the TBC on the surface of the bond coat so as to recrystallize at least a surface region of the bond coat, wherein new grains form within the additive layer at the surface of the bond coat (Claim 11), specifically heat treating at a temperature and for a duration sufficient to recrystallize the entire additive layer of the bond coat, wherein equiaxial grains form within the additive layer (Claim 20), and (3) producing new grains that have a grain size of about 15 to 30 micrometers (Claim 20). Nakamura et al. teaches that, after depositing a diffusion coating layer of Al (i.e., a diffusion aluminide bond coat) on the surface of a gas turbine component such as a blade (i.e., a process analogous to that taught by the AAPA), the diffusion coating layer is shot-peened and then heated to a temperature at or above the recrystallization temperature of the coating layer, thereby causing

recrystallized grains (i.e., "new grains") to form on the surface of the diffusion coating layer (i.e., in the additive layer of the diffusion aluminide bond coat) (Abstract). This recrystallization process advantageously allows the component / coating (1) to have an improved thermal fatigue resistance without deteriorating the corrosion resistance, (2) to have a low crack propagation speed due to the small grain size of the recrystallized grains, and (3) to have an increased resistance to the coating layer peeling-off (Abstract). Therefore, it would have been obvious to one of ordinary skill in the art to improve the thermal fatigue life of the TBC system of the AAPA by modifying the grain structure of the aluminide bond coat by recrystallizing at least a surface region of the aluminide bond coat prior to depositing the TBC on the surface of the bond coat, wherein new grains form at the surface of the bond coat, as taught by Nakamura et al., with the reasonable expectation of successfully and advantageously providing the coated superalloy component / blade of the AAPA with the following benefits: (1) an improved thermal fatigue resistance, (2) a lower crack propagation speed, and (3) an increased resistance to the peeling-off of the coating layer (i.e., the TBC system). The combination of the AAPA and Nakamura et al. does not explicitly teach the applicant's claimed peening intensity. However, it would have been obvious to one of ordinary skill in the art to optimize the peening intensity of the combination of the AAPA and Nakamura et al. through routine experimentation in light of the teachings of Loersch et al. (see paragraph 17 above). Regarding Claim 20, the combination of the AAPA, Nakamura et al., and Loersch et al. does not explicitly teach that the entire additive layer of the bond coat is recrystallized by the

heat-treatment step. However, Nakamura et al. does teach that the outermost surface of the diffusion coating layer is recrystallized (Abstract). This "outermost surface of the diffusion coating layer" appears to correspond to the "additive layer" of the AAPA (i.e., as opposed to the diffusion zone portion of the diffusion coating, which is located within the component itself). It would have been obvious to one of ordinary skill in the art to heat-treat the diffusion bond coating of the AAPA for a temperature and time sufficient to recrystallize the entire additive layer of the bond coat with the reasonable expectation of successfully and advantageously maximizing the benefits of the recrystallization taught by Nakamura et al., such as providing the entire additive layer with a relatively small grain size, thereby most effectively retarding crack propagation. Further regarding Claim 20, the combination of the AAPA, Nakamura et al., and Loersch et al. does not explicitly teach that the new grains are equiaxial and have a grain size of from 15 to 30 micrometers. Specifically, the aforementioned combination is silent regarding the orientation and size of the recrystallized grains. However, the combination of the AAPA, Nakamura et al., and Loersch et al. teaches each and every process step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the grain orientation and size obtained by the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process utilized by the applicant, and the combination of the

AAPA, Nakamura et al., and Loersch et al. teaches the claimed recrystallization (i.e., peening / heating) process, the process of the combination of the AAPA, Nakamura et al., and Loersch et al. would have inherently produced equiaxial grains having a size of from 15 to 30 micrometers, unless essential process steps and/or limitations are missing from the applicant's claims.

19. The combination of the AAPA, Nakamura et al., and Loersch et al. also teaches all the limitations of Claims 13 – 19 as set forth above in paragraph 18 and below, including a method wherein / further comprising:

- Claim 13: The new grains have a grain size of not smaller than 5 micrometers after the TBC has been deposited. Specifically, although Nakamura et al. teaches that the new grains are “small” and “fine” (Abstract), Nakamura et al. is silent as to the specific size of the recrystallized grains. However, the combination of the AAPA, Nakamura et al., and Loersch et al. teaches each and every process step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the grain size obtained by the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process utilized by the applicant, and the aforementioned combination of references teaches the claimed recrystallization (i.e., peening / heating) process, the process of the combination references would have inherently produced new



grains having a grain size of not smaller than 5 micrometers unless essential process steps and/or limitations are missing from the applicant's claims.

- Claim 14: The new grains are substantially equiaxed. Specifically, Nakamura et al. is silent regarding the orientation of the recrystallized grains. However, the combination of the AAPA, Nakamura et al., and Loersch et al. teaches each and every process step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the grain orientation obtained by the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process utilized by the applicant, and the combination of references teaches the claimed recrystallization (i.e., peening / heating) process, the process of the combination of references would have inherently produced substantially equiaxed grains unless essential process steps and/or limitations are missing from the applicant's claims.
- Claim 15: The aluminide bond coat is a single-phase or two-phase aluminide (page 9, lines 17 – 19, of the applicant's specification).
- Claim 16: Precipitates are substantially absent from the grain boundaries. Specifically, the combination of the AAPA, Nakamura et al., and Loersch et al. is silent regarding precipitates at the grain boundaries. However, the aforementioned combination of references teaches each and every process

step and limitation of the applicant's claims, including the type of aluminide bond coat utilized, the step of peening the bond coat prior to heat-treating the bond coat, and the step of recrystallizing the bond coat by heating the bond coat at a temperature at or above the recrystallization temperature. Since the lack of grain boundary precipitates obtained in the applicant's claimed process is simply a function of the recrystallization (i.e., peening / heating) process utilized by the applicant, and the combination of the AAPA, Nakamura et al., and Loersch et al. teaches the claimed recrystallization (i.e., peening / heating) process, the process of the aforementioned combination of references would have inherently produced a bond coat having substantially no precipitates at the grain boundaries unless essential process steps and/or limitations are missing from the applicant's claims.

- Claim 17: The aluminide bond coat is single-phase aluminide (page 9, lines 17 – 19, of the applicant's specification).
- Claim 18: The aluminide bond coat is a diffusion aluminide bond coat (page 8, lines 32 – 33, and page 9, lines 17 – 19, of the applicant's specification).
- Claim 19: The aluminide bond coat is an "overlay" aluminide bond coat. Specifically, since at least a portion of the aluminide bond coat (i.e., the additive layer "28") overlies the substrate (Figure 2, reference number "28", page 8, lines 9 – 11 and 34, and page 9, line 1, of the applicant's specification), the aluminide bond coat of the AAPA has been reasonably interpreted to be an "overlay aluminide bond coat", as required by Claim 19.

20. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) in view of Nakamura et al. (JP 01-180959 A), and in further view of Duhl et al. (USPN 4,512,817).
21. The combination of the AAPA and Nakamura et al. teaches all the limitations of Claim 3 as set forth above in paragraph 14, except for a method wherein the aluminide bond coat is heated to a temperature of about 1090° C to about 1120° C. Specifically, Nakamura et al. teaches heating the bond coat to a temperature at or above the recrystallization temperature of the coating (Abstract) and gives a specific example of heating to a temperature of 900° C (sections (9) and (10) of Nakamura et al., as verified by an oral translation from a USPTO translator). Duhl et al. teaches that the temperature of the post-deposition heat treatment of a bond coating is a result / effective variable that depends on various factors such as (1) the amount of coating interdiffusion desired, (2) the type of coating, (3) the substrate composition, and (4) the coating thickness (Col.3, lines 8 – 40). A high heat treatment temperature such as 2050° F (i.e., 1121° C – “about 1120° C”, as claimed by the applicant) can be utilized (Col.4, lines 7 – 16). It would have been obvious to one of ordinary skill in the art to utilize a high heat treatment temperature of, for example, about 1120° C (as taught by Duhl et al.), in the process of the combination of the AAPA and Nakamura et al. with the reasonable expectation of (1) success, as Nakamura et al. teaches heating the bond coat to a temperature at or above the recrystallization temperature of the coating (i.e., does not appear to place an upper

limit on the heat treatment temperature) and (2) obtaining the benefit of using a higher heat treatment temperature than the 900° C temperature explicitly taught by Nakamura et al., such as performing the recrystallization more quickly, thereby increasing process throughput.

22. In the alternative to the reasoning set forth in paragraph 15 above, Claim 10 is

rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) in view of Nakamura et al. (JP 01-180959 A), and in further view of either Burns et al. (USPN 6,042,898) or Maloney (USPN 6,365,236 B1).

23. Specifically, the combination of the AAPA and Nakamura et al. teaches all the

limitations of Claim 10 as set forth above in paragraphs 14 and 15, except for a method wherein the aluminide bond coat is an overlay aluminide bond coat.

However, both Burns et al. and Maloney teach that it was known in the art of TBCs at the time of the applicant's invention to peen and then subsequently heat-treat – a process analogous to that taught by Nakamura et al. – MCrAlY (i.e., “overlay aluminide”) bond coats in order to improve the properties of the bond coats (Abstract, Col.2, lines 61 – 67, Col.3, lines 1 – 32, and Col.4, lines 24 – 31 of Burns et al., and Col.4, lines 27 – 32 and 39 – 54, Col.6, lines 43 – 67, and Col.7, lines 1 – 10 of Maloney). Therefore, it would have been obvious to one of ordinary skill in the art to perform the process of the combination of the AAPA and Nakamura et al. on an “overlay aluminide bond coat” with the reasonable expectation of successfully and advantageously providing the overlay-coated superalloy component / blade with

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the following benefits: (1) an improved thermal fatigue resistance, (2) a lower crack propagation speed, and (3) an increased resistance to the peeling-off of the coating layer (i.e., the TBC system), as taught by Nakamura et al.

24. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) in view of Nakamura et al. (JP 01-180959 A), in further view of Loersch et al. (USPN 4,514,469), and in further view of Duhl et al. (USPN 4,512,817).

25. The combination of the AAPA, Nakamura et al., and Loersch et al. teaches all the limitations of Claim 12 as set forth above in paragraph 18, except for a method wherein the aluminide bond coat is heated to a temperature of about 1090° C to about 1120° C. However, this limitation would have been obvious to one of ordinary skill in the art in view of the teachings of Duhl et al. (see paragraph 21 above).

26. In the alternative to the reasoning set forth in paragraph 19 above, Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) in view of Nakamura et al. (JP 01-180959 A), in further view of Loersch et al. (USPN 4,514,469), and in further view of either Burns et al. (USPN 6,042,898) or Maloney (USPN 6,365,236 B1).

27. Specifically, the combination of the AAPA, Nakamura et al., and Loersch et al. teaches all the limitations of Claim 19 as set forth above in paragraph 18, except for a method wherein the aluminide bond coat is an overlay aluminide bond coat.

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However, this limitation would have been obvious to one of ordinary skill in the art in light of the teachings of either Burns et al. or Maloney for the reasons set forth in paragraph 23 above.

### ***Double Patenting***

28. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969). A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b). Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

29. Claims 1 – 20 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1 – 22 of U.S. Patent No. 6,565,672 B2 in view of the applicant's admitted prior art (AAPA).

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30. Specifically, Claims 1 – 22 of U.S. Patent No. 6,565,672 B2 teaches all the limitations of Claims 1 – 20 of the instant application, such as depositing a (diffusion) aluminide bond coating on the surface of a superalloy component, peening the bond coating at an intensity of about 6A to about 12A (i.e., the peening intensity claimed by the applicant), heat-treating the bond coating at a temperature of from about 1800° F to about 2100° F (i.e., a temperature encompassing the temperature range claimed by the applicant), and then depositing a TBC on the bond coating, but does not explicitly teach the specifics of the “as-deposited” aluminide bond coat (i.e., that the bond coat is deposited by VPA or CVD, has an additive layer and a diffusion zone, has the claimed columnar grain structure, and can be single-phase or two-phase). Specifically, Claims 1 – 22 of U.S. Patent No. 6,565,672 B2 are silent as to how the aluminide bond coating is deposited and its “as-deposited” structure. However, the AAPA teaches that aluminide bond coats are conventionally deposited by VPA or CVD, have an additive layer and a diffusion zone, have a columnar grain structure, and can be either single-phase or two-phase (See “PRIOR ART” Figures 2 – 5, page 8, lines 8 – 34, page 9, lines 1 – 35, and page 10, lines 1 – 24, of the applicant’s specification, which depict and describe a TBC system of a type known in the art). Therefore, it would have been obvious to one of ordinary skill in the art to deposit the aluminide bond coating of Claims 1 – 22 of U.S. Patent No. 6,565,672 B2 by CVD or VPA (as taught by the AAPA), thereby causing the bond coating to have the structure claimed by the applicant, with the reasonable expectation of successfully and advantageously utilizing a well-known and conventional method to

deposit the aluminide bond coat. One of ordinary skill in the art would have been motivated to look to the AAPA for such a method because the claims of U.S. Patent No. 6,565,672 B2 are silent regarding how the bond coat is deposited. The remainder of the limitations recited in the claims of the instant application (i.e., that the peening / heating process causes recrystallization of the bond coat and improves the thermal fatigue life of the TBC, the specific size and orientation of the "new grains", and the lack of precipitates at the grain boundaries) are all inherent in the process of the combination of Claims 1 – 22 of U.S. Patent No. 6,565,672 and the AAPA because, since the processes are the same, the benefits / grain structure obtained by using the processes would also necessarily be the same.

31. Claims 1 – 20 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1 – 26 of copending Application No. 09/944,705, published as US 2003/0041926 A1, in view of the AAPA. This is a provisional obviousness-type double patenting rejection.

32. Specifically, Claims 1 – 26 of US 2003/0041926 A1 teaches all the limitations of Claims 1 – 20 of the instant application, such as depositing a (diffusion) aluminide bond coating on the surface of a superalloy component, peening the bond coating at an intensity of about 6A to about 12A (i.e., the peening intensity claimed by the applicant), heat-treating the bond coating at a temperature of from about 1800° F to about 2100° F (i.e., a temperature encompassing the temperature range claimed by the applicant), and then depositing a TBC on the bond coating, but does not



explicitly teach the specifics of the “as-deposited” aluminide bond coat (i.e., that the bond coat is deposited by VPA or CVD, has an additive layer and a diffusion zone, has the claimed columnar grain structure, and can be single-phase or two-phase). Specifically, Claims 1 – 26 of US 2003/0041926 A1 are silent as to how the aluminide bond coating is deposited and its “as-deposited” structure. However, the AAPA teaches that aluminide bond coats are conventionally deposited by VPA or CVD, have an additive layer and a diffusion zone, have a columnar grain structure, and can be either single-phase or two-phase (See “PRIOR ART” Figures 2 – 5, page 8, lines 8 – 34, page 9, lines 1 – 35, and page 10, lines 1 – 24, of the applicant’s specification, which depict and describe a TBC system of a type known in the art). Therefore, it would have been obvious to one of ordinary skill in the art to deposit the aluminide bond coating of Claims 1 – 26 of US 2003/0041926 A1 by CVD or VPA (as taught by the AAPA), thereby causing the bond coating to have the structure claimed by the applicant, with the reasonable expectation of successfully and advantageously utilizing a well-known and conventional method to deposit the aluminide bond coat. One of ordinary skill in the art would have been motivated to look to the AAPA for such a method because the claims of US 2003/0041926 A1 are silent regarding how the bond coat is deposited. The remainder of the limitations recited in the claims of the instant application (i.e., that the peening / heating process causes recrystallization of the bond coat and improves the thermal fatigue life of the TBC, the specific size and orientation of the “new grains”, and the lack of precipitates at the grain boundaries) are all inherent in the process of the

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combination of Claims 1 – 26 of US 2003/0041926 A1 and the AAPA because, since the processes are the same, the benefits / grain structure obtained by using the processes would also necessarily be the same.

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



WDM

Wesley D Markham  
Examiner  
Art Unit 1762



SHRIVE P. BECK  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700

### **Election/Restrictions**

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-20, drawn to method of improving the thermal fatigue of a TBC, classified in class 427, subclass 252.
- II. Claims 21-39, drawn to an aluminide bond coat, classified in class 428, subclass 632

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product may be made by a materially different process. The article may be made by casting the substrate onto the coating in a lift-off process. Also, the method may be used to make a materially different product. The article has a diffusion zone, while the method teaches no such zone.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Dave Narciso on February 14, 2002 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-20. Affirmation of this election must be made by applicant in replying to this Office action. Claims 21-39 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

JCM